MINERAL CONTENT AND PHYSICO-CHEMICAL CHARACTERISTICS IN TERASA'S FOREST HONEY

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ABSTRACT

We were found 14 mineral essential and non-essential in Terasa's forest honey using ICP-OES. Characteristic moisture content, ash content, electrical conductivity and pH are also performed. The Largest mineral content of honey is K up to 113,74 mg/L followed by Ca, Mg dan Na (mg/L), respectively 80,68; 28,37; 17,1. Some micro mineral found in Terasa's honey such as; Fe, Se, Ni, V and Co (mg/L), respectively 0,976; 0,078; 0,11; 0,042; dan 0,035. Heavy metal Cd is also present in very small concentrations average 0,005 mg/L

Keyword; multifloral honey, mineral content, moisture content, ash content, conductivity, pH

1. INTRODUCTION

The mineral content of honey depends on the absorption of minerals from the soil and the environment [13]. Terasa's village where the land is latosol soil that are found in tropical rain forests and acidic . Latosol soil generally has a mineral content of Fe and Al were high [2]. In Indonesia, soil latosol generally derived from the parent rock of volcanic, both tuff and igneous rocks, there from the beach to a height of 900m with topography sloping, undulating, vulcanic fan to the mountains premises wet climate of tropical rainfall 2.500-7.000 mm [3], Spermonde Islands which are part of the Sulawesi island is thought to have a correlation with the geographical conditions Feels village, so it can indirectly affect the existence of mineral Terasa Village area .

Mineral content in honey is about 0,04 to 0,2% depending on whether it is light or dark colored honey, dark honey contains higher level of mineral [18]. Twenty-seven different mineral elements have been measured in honey produced in 9 different countries. So far already been shown that not all honey contains all 27 elements [18]. Thus indirectly show that mineral content in honey may indicate the botanical origin of honey [1].

Besides knowledge of the physical and chemical characteristics of honey can become reference for application of the handling, storage and processing of honey. Various parameters have been used such as color, conductivity, pH, water content, and mineral analysis to determine the quality and type of honey that is produced [10]. Several studies [1,9,3] explain that the quality of the honey can be seen from the physical and chemical parameters of minerals contained therein.

Based on the above, we need the basis of data to do research on the characteristics of physics - chemical and mineral content (macro and micro) forest honey Terasa's Village West Sinjai district. The study was conducted by identifying minerals (macro and micro) and heavy metals as well as physic-chemical parameters such as; water content, pH, electrical conductivity and ash content .

2. MATERIALS AND METHODS

2.1 honey samples

Sampling multiflora honey was carried out in the forest Terasa village, district West Sinjai, Sinjai South Sulawesi. Honey samples were taken from at five different points. All samples were placed in a container that is free of contamination.

2.2 Analysis of metal

Honey sample preparation using wet digestion procedure which weighed 1 g of honey sample and put into a beaker, add 2 mL of 0.1 M HNO_3 and the mixture was stirred on a heating plate to almost complete dryness. Then added with 10 mL of 0.1 M HNO_3 and stirred. Then placed in a 25 mL flask with the addition of distilled water. Mineral testing was done using ICP OES brand Perkin Elmer 8000 type optima.

2.3 Water Content

Determination of moisture content using the ICH [6] with interpretation determined based on the value of refractive index samples on temperature 20 ^oC using Atago refractometer.

2.4 Ash content

Determination of ash content used AOAC method: Ashes were obtained by ashing in a furnace at 550 ^oC for 5 hours to obtain constant weight.

2.5 Electrical conductivity and pH

These variables were determined using IHC method where 10 g of honey were dissolved in 75 mL of distilled water. 3.1 *Determination of Water Content*

3. RESULT

Results of the analysis of water content Terasa honey can be seen in Table 1.

Table 1.Analysis result of physics-chemical parameters Terasa Honey samples.

Honey Sample	Total mineral in honey (mg/L)	Water content (% b/b)	pH	ash (% b/b)	EC (mS/cm)
EM1	186.719	21.0	4,72	0,498	0,582
EM2	156.462	21.4	4,76	0,477	0,555
EM3	138.112	21.6	4,78	0,473	0,575
CD1	160.794	28,3	4,79	0,987	0,632
CD2	104.216	21.0	5,20	0,526	0,49
average	149.261	22.66	4,85	0,592	0,567

Almost all the samples of honey has a water content above the standard value SNI 2013 and IHC (maximum 21%) is between 21.0 to 28.3 % except the honey samples EM1 which has a water content the maximum limit is 21.0 %. Honey CD2 has the highest water content is 28.3 % and the lowest levels in honey EM1 is 21.0 % .

Differences in honey water content related to climatic conditions and the level of maturity of honey. The water content of honey is usually dependent on the origin of honey nectar and water content of the nectar source plants [11]. The water content plays an important role in the storage of honey. If the moisture content exceeds 22% , the possibility of having fermented honey [11].

In comparison with the previous research literature gives values lower water content than Terasa's honey (see Table 1) is the Turkey's Honey [11] that the average value of 16.66 % ; honey from Nigeria [12] with an average water content of 16.66 %; honey from Argentina [7] with an average value of 16.24 %; while honey from Malaysia [13] gives the value of the higher water content have a range of values that are similar to Terasa honey an average of 20.62 % . Similarities between the characteristics of the water content of Terasa's honey and honey from Malaysia this could be caused because both are in the tropics

3.2. Determination of pH, ash content and Electrical Conductivity

Data analysis Terasa's honey pH listed in Table 1. The pH value of Terasa honey still meet the quality standards of honey by IHC (4.72 - 5.2). As a comparison value is the pH value of honey from Nigeria [12] which has a pH range which is almost the same average pH of 4.7 and also honey Argentina [7] an average of 3.85. While on the other literature data on honey from Malaysia [8] has a lower pH range average of 3.38. PH is a useful parameter to determine the possibility of microbial contamination and

affect the storage, texture, stability and a shelf life of honey. Most bacteria and fungi grow in an environment that is neutral and slightly alkaline, while the yeast was able to grow in an acid environment of pH = 4.0 to 4.5 and will not grow in alkaline media [11]. Results of this analysis showed that the pH values of honey Feels necessary handling techniques to prevent the growth of mold and honey Feels pH is at optimal growth range.

The average value of the ash content of honey for each sample varies between 0.477 to 0.987 % , and an average of 0.592 % (Table 1) . Honey EM1 , EM2 and EM3 , the ash content is still within the range specified IHC is < 0.5 % and SNI 2013 is 0.57% except for samples of honey CD1 and CD2 are 0.987 % and 0.526 % of ash content value has exceeded the threshold as specified IHC, whereas if based on the SNI 2013 only CD1 honey that passes the threshold. Lower value of ash content based on the literature reported from Turkey honey with an average value of 0.20 % [11]; ash content of Nigerian honey with an average value of 0.63 % [12] ; ash content of honey from Argentina [7] with an average of 0:11 %

Electrical Conductivity/EC (mS / cm) Terasa honey ranged from 0.490 to 0.632 with an average value of 0.567 mS / cm (Table 1). The average value obtained for Terasa honey still below from the maximum limit indicated by IHC and the European Union to standard flower honey / nectar (0.8 mS / cm).

Higher values obtained data from Malaysia honey [16] gives the average value of electrical conductivity - 1:47 average mS / cm . While the lower value is found in Estonia honey [15] with an average value of 0.2 mS / cm . EC value depends on ash content and acidity in honey that is where the higher the content, the higher its EC [16].

Correlated significantly to the mineral content of honey is often used to characterize the botanical origin of honey [5]. EC honey is closely related to the concentration of mineral salts, organic acids and proteins. This parameter shows the great variability according to the origin of flowers, and it is important for the differentiation of the origin of honey different interest [11]. Therefore, EC is often used in the handling qualities of honey [11].

3.3. Mineral Content

There are 14 types of minerals found in honey of five sample with a concentration in mg / L, as shown in Table 2. Some honey mineral found in very small quantities while others are not detected. Total average mineral content of each of honey is determined by adding all the minerals identified in honey.

4. DISCUSSION

4.1 . Water content

Factors that contribute to the high water content of Terasa honey is caused by among sampling conducted in December 2014 - February 2015 which is the peak of the rainy season. Honey with nature hygroscopic easily absorb water and humidity of the surrounding air. This is consistent with the statement from Bogdanov (1999) , which states that the honey samples from the country - tropical countries generally have a higher water content . The water content of the samples of honey which enables high due to the high volume of annual rainfall in tropical regions and also the immaturity of honey itself , specifically for honey CD1 also has a high water content due to the time sampling is the peak of the rainy season in the Terasa village so also allows affecting high water content in the honey samples . While on the other honey samples were taken at the beginning and end of the rainy season .

4.2. pH, ash content and Electrical Conductivity

The ash content is a quality criteria are used to determine the botanical and geographical source of honey samples [11]. The difference value ash content in honey can be caused by the process of harvesting, beekeeping techniques and materials to collect honey, nectar sources besides differences can also affect the ash content of honey [11]. The high content of minerals contained in honey CD1 be the cause of the high ash content in

the sample. In addition Terasa honey harvesting techniques are still using traditional squeeze technique that allows honey mixed with pollen.

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4.3. Mineral

The mineral content of honey is made up of essential macro minerals, essential micro and trace elements. Macro minerals, among others, Ca, K, Na, Mg. Potassium is a mineral that most around 113.7420 mg / L followed by Ca, Mg and Na each 16.1360 mg / L, 5.6730 mg / L and 3.4028 mg / L. In general macro-mineral content of honey was still lower than the honey from other countries, including New Zealand honey [18] found some macro mineral with an average concentration (in ppm) respectively K (1053.2); Mg (24.75); Ca (50.92) and Na (23.93). Furthermore, honey from Argentina [9] with the mineral content of K 816.2 ug / g, Na 33.19 ug / g and Mg 22.64. The mineral content in honey Malaysia [16] with K, Ca, Mg and Na is the largest element in the amount of respectively 1349.34; 183.67; 64.46; and 236.8 mg / kg. The mineral content of honey is also still relies Noticeably lower than reported in other countries [11,5,4].

Some micro minerals found in Terasa honey like Fe, Mn, Se, Co, and Ni. Iron (Fe) is a macro minerals in the Earth's crust, but in biological systems of the body is a micro minerals. Fe concentrations in Terasa honey 0.9756 mg / L, Mn 0.2748 mg / L, Se 0.0778 mg / L, Co 0.0348 mg / L and Ni 0.0106 mg / L (Table 2). Heavy metal cadmium (Cd) 0.0050 mg / L, also found in Terasa honey but in very small concentrations.

Some minerals and trace elements that are essential to the human body. Calcium (Ca) is a major component of bone, which is essential for normal functioning of the heart muscle, blood clotting, milk clotting and regulation of cell permeability. Magnesium (Mg) set up a simulation of nerve, muscle contraction and maintain osmotic balance. Potassium (K) is an important part of the ion balance of the human body and maintain tissue stimulation. Zn and Fe components are contained in a metal enzyme, plays an important role in promoting the metabolism of the organism, strengthen the immune system and prevent disease [17] .

Copper is an important compound but also toxic to many biological systems , is essential for energy production in cells, is also involved in nerve conduction, connective tissue, the cardiovascular system and the immune system [19].

5. Conclusion

Fourteen minerals were found in forest honey Terasa village. Potassium is the most abundant mineral with a percentage of 72.63%

Table 2. Results of the analysis of mineral content in Terasa honey in mg / L.

Mineral	EM1	EM2	EM3	CD1	CD2	Average
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Al 96,153	0.462	6.940	0.251	1.084	1.548	2.057
Cd 226,502	0.005	0.005	0.005	0.005	0.005	0.005
Co 228,616	0.032	0.051	0.028	0.037	0.026	0.035
Cr 205,560	0.006	0.006	0.004	0.006	0.008	0.006
Cu 324,206	0.045	0.043	0.032	0.026	0.026	0.034
K 766,490	133.100	118.800	114.700	133.000	69.110	113.742
Mn 257,610	0.134	0.212	0.120	0.332	0.576	0.275
Ni 231,604	0.007	0.012	0.005	0.017	0.012	0.011
Se 196,026	0.100	0.090	0.080	0.059	0.060	0.078
V 292,402	0.010	0.170	0.010	0.011	0.011	0.042
Zn 213,857	23.210	TDT	1.035	TDT	TDT	12.123
Ca 317,933	15.420	16.900	13.240	16.480	18.640	16.136
Fe 238,204	0.406	2.940	0.233	0.518	0.781	0.976
Mg 280,271	4.649	5.185	4.065	4.899	9.567	5.673
Na 330,237	7.080	2.783	2.604	2.352	2.195	3.403

of the total mineral content of the honey sample and also meet the standards of Honey SNI 2013 because not found heavy metals Pb and As, and Cd metal concentrations are very low. In general, results physico-chemical parameters of honey quality village still good, just needs to be a water content in order to meet the standards SNI of honey 2013

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